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Journal of the Society of Arts.

FRIDAY, AUGUST 1, 1862.

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INTERNATIONAL EXHIBITION OF 1862.

GUARANTEE.

The Council beg to announce that the Guarantee Deed is still lying at the Society's House for signature, and they will be much obliged if those gentlemen who have given in their names as Guarantors, as well as others interested in the Exhibition, will make it convenient to call there and attach their signatures to the Document. Signatures for sums amounting in the aggregate of £452,100, have been attached to the Deed.

SEASON TICKETS.

Season Tickets may be obtained at the Society's House, on application to Mr. S. T. Davenport, Financial Officer. The prices of the tickets are as follows:—£2 10s., admitting to the International Exhibition and the Gardens of the Royal Horticultural Society every day during the remainder of the season; £1 10s., admitting to the Exhibition only, every day; and 10s., admitting to the Exhibition on shilling days only.

CONVERSAZIONE.

The third Conversazione of the present season will take place at the South Kensington Museum on the 8th October.

ARTISTIC COPYRIGHT.

The Bill, with amendments inserted by the House of Lords, has now passed, and received the Royal Assent on Tuesday last.

NOTICE TO INSTITUTIONS.

A limited number of copies of a work entitled "The Iliad of Homer, faithfully translated into un-rhymed English Metre," by Francis W. Newman, Professor of Latin, University College, London, has been kindly presented by the author to the Council of the Society of Arts, for distribution amongst such Institutions in union with the Society as may desire to add this work to their Libraries.

Any Institution desiring to have a copy, should apply to the Secretary of the Society of Arts.

Those Institutions who have already applied, are informed that copies will be sent as soon as they are received from the publishers.

NEW SOUTH WALES.

The following paper forms the introduction to the Special Catalogue of the products of this colony shown in the International Exhibition:—

The eastern part of Australia was discovered by Cook in his first voyage in 1770. The bold character of the coast, and the broken outline of inland mountain, seen from the deck of the *Endeavour*, recalled to his recollection the well-known features of South Wales, and suggested the somewhat infelicitous, but now familiar, name of New South Wales. On the 26th of January, 1788, the first settlers, 1,030 in number, landed at the head of Sydney Cove, in Port Jackson, and the governor, Captain Arthur Philip, R.N., proclaimed the limits of the new colony to be—

On the east, the ocean from South Cape, in S. lat. 43° 40 to Cape York in S. lat. 10° 42′. On the west the 135° of E. long. On the north and south, the ocean.

Since that period various portions of the vast territor comprised within these limits have been cut off from the parent colony and formed into the following distinct dependencies, viz.:—The island of Tasmania in 1803, separated from the mainland by the straight which Bass first discovered in 1798; South Australia in 1836; Victoria in 1851; and Queensland in 1859. The colony of New South Wales has thus, by these successive curtailments, been reduced within limits comparatively narrow, but still comprising an area of 207,000,000 acres, defined by the following geographical discoveries:—

On the east, the sea from Cape Howe (S. lat. 38° 31′) to Point Danger (S. lat. 28° 8′), forming a seaboard of upwards of 700 miles.

On the south, from Cape Howe, a line north-westerly to the source of the River Murray, and by the north bank of that river to the 141° E. longitude (the eastern boundary of South Australia).

On the west, by a line north along the 141° east longitude to the 29th parallel of south latitude.

On the north, from Point Danger a line westerly by a mountain chain, to the great dividing range; following this range to the 29° S. lat., thence by a lesser hill-chain to the River Severn, along its course to the River Macintyre, and by this river until it again reaches the 29° S. lat., and thence by this parallel westward until it reaches the 141° longitude.

It would on the present occasion be out of place to enter into a detailed history of the rise and progress of this colony; but it is felt that a general account of the present stage of its development, its population, its natural products, its industrial resources, and its commercial operations, will be read with interest, and will be considered an appropriate introduction to the catalogue of its contributions to the International Exhibition of 1862. The statistics, however, of New South Wales proper would give a very imperfect idea of the results which the original settlement in that colony in 1788 have produced in the short space of 72 years, ending the 31st of December, 1860; for three of the four colonies above mentioned spring directly from that event, and even South Australia, which derives its origin from an independent source, owes one of its staple exports and its supplies of animal food to the abundance of New South Wales; it is not, therefore, historically untrue to include in a statistical estimate of that event all the results which have been accomplished within the territory originally assigned to that colony; these are—

An aggregate population of	1,124,477
An aggregate revenue of...	£5,170,563
An aggregate import and export trade (real colonial value) of	£47,367,126

With this observation we may now pass on to the special statistics of New South Wales, the facts of which have been furnished by Christopher Rolleston, Esq., the registrar of the colony.

I. Population.

1. The population on the 7th April, 1861, was 350,860 souls (198,488 males and 152,372 females), exclusive of the military and aboriginal inhabitants. The subsequent increase by births and by immigration will probably bring the numbers at the end of the year up to 360,000, about 205,000 males, and 155,000 females, the proportion being about 75 females to every 100 males.

2. The total area of New South Wales is computed at 323,437 miles, or 207,000,000 acres; that is, more than five times the area of England and Wales, and more than three times the area of England, Wales, and Scotland united. By the census of 1851, the quantity of land in England and Wales to every 200 persons living was 373 acres. By the census of 1861, there were in New South Wales 575 acres to each person—that is, in the colony the proportion of land to population is 310 times greater than it is in England and Wales.

3. The county of Cumberland—the metropolitan county—inclusive of Sydney, averages about 86 persons to a square mile; but, exclusive of Sydney, only 47 persons to a square mile. The average of the nineteen settled counties is rather under four persons to a square mile, whilst the extensive pastoral districts average barely one person *to* four square miles.

Without exceeding the density of the population as it exists in the county of Cumberland, exclusive of Sydney, New South Wales would admit of a population exceeding fifteen millions of souls, or nearly forty-four times the number of its present inhabitants; and were the colony peopled as densely as England, it would contain 103,500,000 inhabitants.

4. The city of Sydney contains 93,686 inhabitants (viz., within the city, 56,394, and in the suburban districts 37,292), or rather more than one-fourth of the total population of the colony. There are 10,185 occupied houses in Sydney, besides stores, public offices, and other buildings. The annual rental of the rateable property, exclusive of public buildings, and crown and vacant lands (estimated at a quarter of a million annually), is assessed at nearly three-quarters of a million, and of the suburban municipalities at nearly half a million* sterling. The annual rate raised upon this property exceeds £50,000.

5. The average annual number of births, since the establishment of a civil registry in the year 1856, has been 41 to every 1000 of the population, whilst the average of England and Wales for the year 1859 was 34 per cent. The average annual number of marriages in New South Wales has been 92 per cent., or nearly 10 to every 1000 of the population. The average of England and Wales for the year 1859 was about 8·4 per 1000.

The average annual mortality during the same period in New South Wales has been at the rate of 17 per 1000 of the population. In England the average for 1859 was about 22 per 1000.

In England the summer quarters of the year, and in New South Wales the winter quarters, are more prolific in births. In England the winter months are the most fatal to life, in New South Wales the summer months exhibit the highest rate of mortality.

6. There were in the colony 53,509 married women, and the number of births in 1860 was 14,233, which gives a proportion of 266 to every 1,000 married women of all ages, whilst in England and Wales the proportion in 1851 was 204 births for every 1,000 married women of all ages.

One of the most important facts brought out by the census of a population is the number that belongs to every age of life; for its relative powers of increase and production depend in a great measure on the proportion of maturity to infancy and decline of natural vigour. In New South Wales, by the census of 1861, there were between the ages of 15 and 45, 168,068 persons (viz., 96,065 males and 71,993 females), or 479 per 1,000 of the total population, whereas in Great Britain (that is England, Wales, Scotland, and adjacent islands), according to the census of 1851, the proportion between the same limits was 458 to every 1000 of the population. For the sake of comparison we may take another period, viz., from 20 to 60. In Great Britain in 1851, the numbers between these ages were 477 in every 1000 of the population, while in the colony in 1861 the proportion was 499 to every 1000. In both cases the comparison as regards physical strength is in favour of the colony. In the English census of 1851, the population of Great Britain was fancifully divided into three classes—the ineffectives, the self-supporting, and the effectives—the ineffectives being those under 10 and over 70, the self-supporting being those from 10 to 20, and from 60 to 70, and the effectives (that is those who not only support themselves but sustain the ineffectives) ranging between the limits of 20 and 60. Out of every 1000 of the population these three classes stood to each other in the following proportion: = 298 : 225 : 477. When the colonial census for 1861 is completed, this classification will afford another salient comparison; at present we are only able to state that in every 1000 of the population, there were 499 effectives to 501 ineffectives and self-supporting.

7. In a country extending over nearly 11 degrees of latitude, and of such varied elevation, great differences of temperature must exist. From observations registered at ten stations in different parts of the colony, it appears that the mean annual temperature ranges from 40° to 75° Fahrenheit. The extreme range, however, in inhabited places shows a wide divergence from these mean levels; the maximum summer heat in some island districts reaching at times 120°, whereas on the high table-lands severe frosts are experienced for some weeks in succession. The climate of Sydney, which is only a few miles from the seaboard, has been not inaptly compared to that of Naples, the difference being only 5° of greater summer heat and winter cold at Naples than at Port Jackson. But changes of temperature are much more violent in the latter locality than in the former, a sudden rise or fall of 30° being of not unfrequent occurrence in the summer season.

The rainfall during the year 1860 over the whole colony averaged 43 inches, the smallest quantity falling in the interior (18 inches), and the largest quantity at Sydney (82 inches). The average number of days upon which rain fell was 124; the smallest number being 64, at Deniliquin, and the largest 182, at Sydney.

The year 1860 has been taken because the returns are more complete for that than for preceding years; but it should be noted that it was a year of unusual wet in the coast districts. The average for a decennial period would probably be very much below what has been observed for the year in question.

II. Occupation.

8. The chief occupations in which the people are engaged may be classed under six heads, viz:—

				Per Cent.
1. Government, Professional, and Trading Classes	Males	13,345		
	Females	2,293		
		15,638	or	4·46
2. Manufacturing and Labouring Classes . .	Males	31,501	„	8·98
3. Gold-mining . .	*Males	20,365	„	5·80
4. Pastoral and Agricultural Classes . .	Males	46,916		
	Females	7,084		
		54,000	„	15·39

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* The municipalities without the city limits assess vacant lands; whereas, within the city, all public buildings and unoccupied lands are excluded from assessment.

* Of the 20,365 persons engaged in gold-mining, 12,600 are Chinese.

5. Personal Offices, Domestic Servants, &c. .	Males	13,683		
	Females	14,490		
		28,173	,,	8·03
6. Miscellaneous, including Women and Children, both at Home and at School.	Males	72,678		
	Females	128,505		
		201,183	,,	57·34

III.—Production.

9. Of the whole of the Australian colonies, New South Wales takes the lead in pastoral industry. The live stock returns on the 31st March, 1861, exhibited the following numbers, viz.: — Sheep, 6,119,163 ; cattle, 2,408,586 ; horses, 251,497. This is at the rate of *seven hundred head* of horned cattle, and rather more than *seventeen hundred* sheep to every hundred of the population.[*]

From New South Wales the flocks and herds of all other colonies derive their origin. In 1797 Capt. John Macarthur of Camden, (a name which must ever occupy the front rank of honour in the annals of Australian progress), being struck with the remarkable effect of the climate of New South Wales on the fleeces of the sheep which had been imported into or bred in the colony, obtained from the Cape of Good Hope three rams and five ewes of pure Spanish merino blood, and crossed all his coarse-woolled ewes with the Spanish rams. The result exceeding his most sanguine expectations, he took an opportunity whilst in this country in 1803 of bringing under the notice of the government the importance of encouraging the growth of fine wool in the colony by making grants of unoccupied lands to the flock masters. The concluding words of his statement, laid before Lord Hobart (then Secretary of State for the Colonies) in 1803, are worth recording:—

"Captain Macarthur is so convinced of the practicability of supplying the country with any quantity of fine wool it may require, that he is earnestly solicitous to prosecute this, as it appears to him, important object; and on his return to New South Wales, to devote his whole attention to accelerate its complete attainment. All the risk attendant on the undertaking he will cheerfully bear —he will require no pecuniary aid—and all the encouragement he humbly solicits is, the protection of government, and permission to occupy a sufficient tract of unoccupied land to feed his flocks."

In 1796 the whole of the live stock in the colony, exclusive of goats and pigs, was 57 horses, 227 cattle, and 1,531; and from this stock have sprung the vast flocks and herds which were feeding on the natural grasses of Australia at the end of 1860, as exhibited in the following table:—

Colony.	Sheep.	Cattle.	Horses.
New South Wales	6,119,163	2,408,586	251,497
Victoria	5,794,127	683,534	69,288
Queensland	3,449,350	432,890	23,504
South Australia.........	2,824,811	278,265	49,399
Tasmania	1,700,930	83,366	21,034
General Totals	19,888,381	3,886,641	314,722

10.—The export of wool from Sydney in 1860 amounted to 12,809,362 lbs., of the estimated value of £1,123,699 sterling. Besides this a considerable quantity crossed the Murray River for shipment at Melbourne, and was sent down the Darling for shipment at Adelaide. In the last ten years (1851 to 1860) there have been exported from Sydney, the produce of the flocks and herds of New South Wales, no less than 158,958,055 lbs. of wool, of the estimated value of £11,051,313, and tallow and hides of the value of £1,663,183, together amounting to the sum of £12,714,496 sterling. Here is abundant evidence of the magnitude and importance to which the pastoral interest has attained; and to this sum should be added the value of the live stock exported to Victoria and elsewhere, amounting, as nearly as can be estimated, to not much less than half a million annually. Take the value, however, at a quarter of a million annually, in order to obviate any chance of exaggeration, and we produce a sum total of £2,500,000, which brings up the pastoral produce of the colony in the ten years to £15,214,496, or over a million and a half sterling per annum. The value of all other colonial produce exported—agricultural, manufacturing, and mining—including gold — does not approach this amount within nearly a million sterling.

11. The month of May, 1851, is remarkable as the era of the gold discovery in New South Wales. In that year the colony exported gold to the value of £468,336, in 1852 to the value of £2,660,946, in 1853 to the value of £1,781,172. In the five following years (1854 to 1858), owing to the superior richness of the Victorian discoveries, gold mining languished in New South Wales, the average produce not exceeding £600,000 per annum. In 1859, however, the yield increased to £1,698,078, and in 1860 to 1,876,049. In the ten years the colony has exported 3,281,000 ozs. troy, representing a value of £11,683,857 sterling.

12. The limits of the great coal field of New South Wales are at present imperfectly known; it is found to extend into Queensland, and to re-appear in Tasmania, but it has not been practically opened out in either of these colonies. The mines now in operation are situate at or in the neighbourhood of Newcastle, at the mouth of the Hunter, 60 miles north of Sydney, and at Bellambi, 43 miles to the south of that city. The total produce of coal in the last ten years has been 1,780,000 tons, of which more than one-half has been shipped to India, China, and the neighbouring colonies.

The present appliances of the collieries in work are equal to the production and shipment or 20,000 tons weekly, and the average price for good screened coal at Newcastle is 12s. to 14s. per ton.

Locomotive engines draw the coals along tramways from the pit to the shipping staiths, where steam cranes and other facilities are in action for the ready loading of vessels of large tonnage.

The further development of this great mineral resource is only arrested by the want of miners. If this want were supplied, there is no doubt that in the course of a few years this coal field would furnish gas and steam fuel throughout the Indian and Pacific Ocean. The quality of the coal from one of the pits was tested at the Royal Arsenal, Woolwich, in 1858, and again in 1859, and the results were highly satisfactory, showing that for steam purposes it is only 7 per cent. inferior to the best Welsh coal, and that, as regards the manufacture of gas, it produces upwards of 9,000 feet per ton, with an illuminating power 24 per cent. greater than the English variety known as Whitworth.

13. The returns of agriculture, taken on the 31st of March, 1861, give a total extent of land under cultivation of 260,798 acres. Of this quantity not quite one-half (128,829 acres) was sown with wheat; nearly one-fifth (51,488 acres) with maize, or Indian corn; another fifth with barley, oats, and artificial grasses for hay and green food for horses and cattle; and the remainder was appropriated to potatoes, vineyards, and orchards.

The average production of wheat is a little over fifteen bushels per acre; this is less than the average produce of Tasmania and of Victoria by three to five bushels, and rather above the average of South Australia. Except in seasons of extreme drought the colony has, on an average, raised rather more than one-half the quantity required for the annual consumption of its inhabitants. In the ten years (1851 to 1860) there have been imported of grain and bread stuff from South America, California, and South

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[*] **In Ireland, at the end of 1861, there were only 61 sheep and 60 horned cattle to every 100 of the population.—*Vide* Agricultural statistics, Ireland.—*Parliamentary Paper.***

Australia, to the annual average value of 370,000*l*. For the whole period a total sum of 3,701,256*l*. has been expended in the importation of bread stuff (including rice) for the support of the population. The production of wheat in 1860-1 was at the rate of 4½ bushels per head of the population, whereas the consumption per head may be reckoned at 7 to 8 bushels, including the quantity required for seed.

14. Maize is grown largely as food for horses, pigs, and poultry. New South Wales and Queensland are the only two of the Australian colonies which are adapted by climate to the production of this valuable cereal. The average production is rather over thirty bushels per acre.[*] It is largely exported to Victoria and the other colonies. No less than 559,226 bushels were shipped outwards last year, of the estimated value of 92,450*l*.

15. Much attention has of late years been bestowed on the cultivation of the vine and the manufacture of wine. There were last year in crop 1,583 acres, but 622 acres only were devoted to wine making. The produce was 99,791 gallons of wine and 709 gallons of brandy, or at the rate of about 110 gallons per acre.[†]

The wines of Australia are too well known to need any remarks here as to their character, and the samples which have been sent to the Exhibition will speak for themselves.

16. The instincts of race are already apparent in the gradual development of manufacturing industry. In 1860, 938 mills and factories were at work, the most important being those engaged in ship building and the manufacture of engines, hardware, cloth and tweeds, leather, soap and candles, refined sugar, and pottery. It may be doubted whether it is to the present advantage of the colony, that any portion of its available labour should be withdrawn from the field, which from climate and pastoral fertility is capable of supplying the old world with an indefinite quantity of raw material; but it must be borne in mind that, as New South Wales possesses to an unlimited extent every one of the mineral resources to which England, in a great measure, owes her wealth and national prosperity, it solely depends on the present direction of her own energies, whether she eventually becomes the manufacturing centre of the Pacific. It is well, therefore, that a commencement has been made, and that the intelligence of its population is already receiving the training and experience which are necessary for the fulfilment of its great destinies.

17. The introduction of alpacas into the colony by Mr. Ledger is worthy of special notice. It is found that the climate and pastures are peculiarly suited to the increase and the fleeces of these animals; and Mr. Ledger calculates that in fifty years the flock will have increased to 9,760,000, producing, at an average of 7 lbs. per head, a clip of 68,320,000 lbs. Let those who may be disposed to reject this estimate as evtravagant, bear in mind the origin of the merino flocks of Australia. In 1807 the export of merino wool from Sydney was 245 lbs.; in 1861 the export from all the Australian colonies and New Zealand was upwards of 68,000,000 lbs.[‡] The first export to England of alpaca wool was made in 1860, and amounted to 677 lbs.

IV. Trade and Internal Communication.

18. There are no features in colonial statistics calculated to impress strangers more strikingly than those which exhibit the trading activity of the comparatively small communities settled on the shores of the Australian continent.

The colonial real value of the imports into New South Wales in the year 1860 exceeded seven millions and a half sterling; this was at the rate of £22 2s. 3d. per head of the population estimated for the middle of the year.

During the last ten years (1851 to 1860) the colony has, on the average, imported annually from Great Britain alone goods to the value of £3,319,926, the aggregate sum reaching the enormous amount of £33,199,268.

The value of the general imports in these ten years amounted to £52,822,429, showing an annual average of more than 5 millions sterling.

19. The value of the exports during the same period is not less remarkable.

The total amount to Great Britain in this decennial period was £20,110,205, the annual average £2,011,020, whilst the general exports amounted to £39,327,726, giving an annual average of nearly 4 millions sterling.

The value of the exports during 1860 exceeded five millions sterling (£5,072,020,) being at the rate of £14 8s. 4d. per head of the population.

It may be worth noticing, that of the total exports during the ten years £29,848,252 or 73·35 per cent. was the produce or the manufacture of New South Wales.

These are the results of the trading of a community, which, in 1851, numbered only 197,168 souls, and in 1861 does not exceed 360,000.

The shipping employed in this trade in the year 1860 was,—inwards, 1424 vessels, of the tonnage of 427,835 tons, with crews numbering 23,833 men and boys,—outwards, 1,438 vessels of 431,484 tons, employing 23,941 men and boys.

20. There are 69 miles of railway in active work, constructed at a total expense of £1,317,840, that is at the rate of nearly £20,000 per mile. The total receipts for the year 1860, passenger and goods traffic, amounted to £61,738, or 4·70 per cent. on the original outlay.

There are 54 miles of railway in progress, and 222 miles projected, at an estimated cost of £2,666,864 exclusive of land.

21. There are 820 miles of main roads kept in order by the Government, and the amount expended in 1860 on roads and bridges, irrespective of those under the control of road trusts and municipalities, was £114,572.

The mileage of roads, not under Government control, has never been made the subject of official investigation, but the municipal expenditure (principally on roads) and the expenditure by the several road trusts in the colony amounted in 1860 to £37,935.

22. Telegraphic communication connects the capitals of the four colonies of Queensland, New South Wales, Victoria, and Australia; the extreme distance being 2,005 miles. Within the limits of New South Wales the telegraphic wires extend over 1,941 miles; the total cost of which amounts to £97,839.

23. The distance travelled by mail conveyance in the year 1860 was 1,461,518 miles.

The number of letters which passed through the General Post Office in Sydney was 4,230,761; of this number 349,670 were for town delivery, 3,012,345 were inland letters, and 868,746 were foreign letters. The total number gives an average of rather more than twelve letters to each person living in the colony in that year.

3,668,783 newspapers passed through the post office in the course of the year, of which 190,478 were foreign and 2,758,305 were colonial. The total number was at the rate of over ten per head of the population.

In addition to the letters and newspapers, 83,736 book packets and petitions went through the post, making a total of 7,983,280 distinct parcels in the course of the year.

The letter rate is 2d. per half-ounce, irrespective of distance; in 1860 the postal receipts were £45,612, and the expenditure £72,371.

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[*] On rich land 70 bushels per acre have not unfrequently been grown.

[†] The average produce of the vineyards of France is computed at 190 gallons per acre.

[‡] The superiority of the average quality of Australian wool to the average quality of that which is imported from all other countries will be seen from the following statement:—In 1861 the total quantity of wool imported was, from Australia and New Zealand, 68,313,903 lbs., and from other countries 75,570,611 lbs., and the computed real value of the former was £5,477,181, or 1s. 7d. per lb., and of the latter £3,015,377, or 9¼d. per lb.—Vide *Trade and Navigation*, 1861: *Parliamentary Paper*.

V. PUBLIC REVENUE AND EXPENDITURE.

24. The total revenue of the colony in 1860, exclusive of loans, was £1,308,925; and the expenditure, including interest on loans, £1,312.777, being at the rate of not quite £4 per head of the population.*

Of the revenue the principal sources were—

	£	Per Cent
Customs, and Duty on Distilled Spirits	599,233	or 45·8
Export duty on gold, and Mint receipts	77,506	,, 5·9
Lands	312,863	,, 23·8
Rents and Licences (exclusive of land)	86,556	,, 6·6
Postage	45,636	,, 3·4
Fines and Fees	31,484	,, 2·4
Railway and Telegraphs	71,405	,, 5·4
Miscellaneous	84,223	,, 6·4

25. The tariff is remarkable for its simplicity, and with one exception (the export duty on gold) is consistent with sound principles of trade. All articles of foreign produce or manufacture are admitted free of duty, excepting the few consumed in "smoking and drinking;" these are fermented and spirituous liquors—tea, sugar, coffee, and chicory—tobacco and opium. Another feature in the tariff, is, that the trade is not hampered by those vexatious refinements of classification, which are still adhered to in England in the case of sugars, and have only been abandoned in the present session in the case of wines.

26. The present rates,† and the amount of duties paid under each head are as follows:—

	£	Per Cent.
Spirits—imported 7s. to 10s. per gallon Ditto, distilled in colony 6s. 5d. to 7s. ...	345,726	or 53·8
Wine—over 25 per cent. alcohol, 10s. per gallon Ditto under do. 2s. ,, Beer—in wood 1d., in bottle 2d. ,,	35,480	,, 5·5
Tobacco 2s. per. lb.; Cigars 3s. per. lb.	89,217	,, 13·9
Tea 3d. ,, ...	45,303	,, 7·0
Sugar—refined 6s. 8d., raw 5s. per cwt. Treacle and Molasses 3s. 4d. ,, ...	71,602	,, 11·1
Coffee and Chicory 2d. per lb.	7,641	,, 1·2
Opium 10s. ,, ...	4,261	,, 0·7
Export duty on gold 2s. 6d. per. oz.	42,635	,, 6.6

The revenue from customs duties on the articles above enumerated was at the rate of £1 17s. 9d. per head of the population.

26. In an earlier portion of this paper it has been stated that the total area of the colony is computed at 207,000.000 acres. Of this quantity 7,170,690 acres only have been alienated; this gives as nearly as possible an average of 20 acres per head of the population, and leaves 199,892,310 acres of which the fee is still in the hands of the crown.

In the last ten years (1851 to 1860), 1,062,058 acres of land have been sold at the aggregate price of £2,054,418, giving an average of £205,441 per annum.

About fifty million acres are held under lease by pastoral occupants, who pay a present rental of £155,000 per annum, being at the rate of not quite ¾ of a penny per acre.

By a colonial Act, passed in 1861, persons are allowed, under certain restrictions as to occupation and improvement, to select rural lands in any part of the colony at a fixed price of 20s. per acre; paying 5s. per acre down at the time of selection, and the remainder at the expiration of three years.

27. The amount of the public debt on the 31st of December, 1860, was £3,830,230, being at the rate of very nearly £11 per head of the population.

This sum is secured on the consolidated revenue of the country. The debentures are issued in sums not less than £100, having for the most part thirty years to run, and bearing interest at 5 per cent. per annum.

The money has been appropriated to railways and other permanent public works, for the most part of a reproductive character.

VI. WAGES AND CONSUMPTION.

28.* The present wages of skilled artizans are 8s. to 10s. per day, without board or lodging; and of farm labourers and shepherds, from £30 to £40 a year, with board and lodging. In the former class, the decline from the rates which ruled in 1854 is considerable, but the wages of persons engaged in agricultural and pastoral industry have suffered comparatively no diminution, and the demand is greater than the supply.

Female domestic servants get ready employment at wages ranging from £26 to £36 per annum.

29. If the artisan receives lower wages, he is in a great measure compensated by the diminished cost of living.

Bread, which in 1854 to 1856 ranged from 5d. to 6d. the 2lb. loaf, is now down to 3½d. Potatoes, which ranged as high as 20s. a hundredweight, are now down to 8s. Meat, which rose to 6d. and 7d. per lb., is now reduced to 3d. and 1½d. per lb., according to quality.

Rents have fallen at least 50 per cent., and, taking the expenditure of the family of an artisan, it may be said that the cost of living has been reduced by nearly one-half.

30. There were imported into New South Wales, and manufactured in the colony together, during the year 1860, 979,616 gallons of spirits, and there were exported 143,870 gallons, leaving 835,746 gallons for consumption, or nearly 2½ gallons to each head of the population.

Of wine, beer, and cider, the excess of imports over exports was 1,700,000 gallons, or an average of 5 gallons to each person—man, woman, and child—in the colony. This is exclusive of wine and beer of colonial manufacture.

31. With regard to tea and sugar, which are largely consumed by the great mass of the people, there were imported into the colony in 1860 no less than 4,937,454 lbs. of tea, and 22,521,124 lbs. of sugar; and there were exported 1,640,520 lbs. of tea, and 6,385,456 lbs. of sugar, leaving a residue for consumption of 3,296,934 lbs. of tea, and 16,135,668 lbs. of sugar, being at the rate of nearly 10 lbs. of tea and 47½ lbs. of sugar for each person in the colony.

VII.—ACCUMULATION.

32. At the end of the year 1860, the savings-banks in the colony (17 in number) showed a total balance of £557,196 14s, to the credit of 12,027 depositors, being at the rate of £46 6s. 7d. per head. Besides this sum there was to the credit of—

	£	s.	d.
Reserve Fund	55,179	0	0
Profit and Loss	8,973	3	0
Drafts unpaid.........	482	14	3

showing a total balance to the credit of these institutions of £622,371 11s. 8d. sterling.

The classification of depositors was as under:—

Not exceeding £20	5,167
From £20 to £50	2,604
From £50 ,, £100	2,070
From £100 ,, £200	2,003
From £200 ,, £300	131
From £300 and upwards...	52
	12,027

The rate of interest paid to depositors is at the rate of 5 per cent. per annum on balances of account withdrawn during the year, and 6 per cent. on deposits remaining in the bank; but no interest is allowed on any sum exceeding £100 deposited by one individual.

33. The coin and bullion in the mint, banks, and treasury, at the end of 1860, amounted to £1,647,265, and the notes in circulation to £949,849, making together, £2,597,114.

The coinage at the mint in 1860 was—1,573,500 sovereigns, and 156,000 half-sovereigns.

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* Revenue £3 17s. per head; Expenditure £3 17s. 2d. per head.

† The duties paid in England on tea, sugar, and foreign manufactured tobacco of the same quality as that used by the masses in New South Wales, are severally 600, 250, and 475 per cent. higher than the colonial rates.

* A skilful coal-hewer could, at the current rate of wages, earn more than 18s. per day if his earnings were not restricted by the interference of the union clubs.

The total issue of coin by the Sydney branch of the Royal Mint, from its opening on the 14th of May, 1855, to the end of the year 1861, has been 7,333,500 sovereigns, and 2,202,500 half-sovereigns, the greater part of which is held in circulation through the Australian colonies.

At the termination of the last quarter of the year 1860, the liabilities in New South Wales of the different banking institutions were as follows:—

Notes in circulation	£949,849
Bills	62,504
Balances due to other banks .	304,277
Deposits	5,164,011
Total	£6,480,641

The assets were—

Coin	£1,578,424
Bullion	90,052
Landed property	239,050
Notes and bills of other banks	60,960
Balances due from „ „	179,914
Notes and bills discounted ...	5,780,700
Total	£8,929,100

The paid-up capital of the banks was £5,804,600. The dividends for the year amounted to upwards of £800,000, or about 14 per cent. on the paid-up capital; and the amount of reserved profits at the time of declaring the dividends was—£1,258,201.*

The practice of allowing interests on fixed deposits, accounts for the large sum of £5,164,000 lying in the banks under the head of "deposits."

VIII.—Educational, Charitable, and Religious Establishments.

34. For the higher departments of education there are the University of Sydney, with its two affiliated residential colleges of St. Paul's and St. John's (the former for members of the Church of England, and the latter for Roman Catholics), the large Sydney Grammar School, and 388 private schools.

The University is governed by a Provost, Vice-Provost, and Senate. The buildings, still incomplete, have been erected at a cost of £60,000, granted by the State; and the University enjoys from the same source an annual subsidy of £5,000 by way of endowment. Professorships in the three departments of classical literature, mathematics, and experimental philosophy have been established; and in 1860, 32 students attended the lectures given by the eminent men who fill those chairs. Since the opening of the University 110 students have matriculated, and 47 have graduated; the degrees taking rank, by the gracious permission of Her Majesty, with those conferred in the English universities. Towards the two affiliated colleges, private munificence has contributed nearly £50,000, and the State has given £40,000, besides an annual endowment of £1,000, viz: £500 to each.

The Sydney Grammar School has been built at the public cost, and receives an annual subsidy of £1,500. In 1860 the number of pupils receiving instruction was 144. At the 383 private schools the number of resident pupils in 1860 was 9,318.

35. In addition to these schools the Public Treasury supports two systems of primary education—the Denominational and Irish National. In 1860 there were 264 Denominational schools with 15,267 scholars, receiving from the State a contribution of £20,031, and from other sources £12,465. In the same year there were 144 National Schools educating 9,305 scholars; receiving from the State £23,445, and from other sources £7,838.

36. Taking the whole of these establishments together, we find that in 1860, 34,769 scholars (about 1 in 10 of the population) were receiving an education suited to their station in life, towards the expenses of which the State contributed the sum of £60,587, not far short of 5 per cent. of the whole public revenue of the colony, and at the rate of £1 14s. 11d. per scholar, the rate in England and Wales being 11s. 6d.

In addition to the above there are 329 Sunday schools, with an average attendance of 21,104 children.

In the large towns and populous districts of the colony, Schools of Art or associations for mutual improvement exist, and a sum of £25,000 has recently been voted by the Legislature for the foundation of a free public library in the city of Sydney—an institution much required, and already exercising the most beneficial influence in the sister capital of Melbourne.

37. The returns for 1860 show that there were 33 institutions established for objects of charity, such as hospitals, benevolent asylums, orphan and ragged schools, &c., &c., supported partly by State and partly by voluntary contributions, at a cost exceeding £50,000 per annum.*

38. The number of ministers of religion in 1860 was as follows:—Church of England—Bishops, 2; Clergy, 114; Total, 116. Roman Catholic Church—Archbishop, 1; Clergy, 59; Total 60. Presbyterians, 52; Wesleyans, 40; Independents, 12; Primitive Methodists, 8; Baptists, 5; Jews, 4; Unitarians, 1; Grand Total, 298.

Taking the estimated population at the middle of the year, this gives one minister to 1,140 persons. These ministers are supported partly from the public revenue which is charged with an annual payment of £28,000 distributed on a certain fixed scale, but principally from local voluntary contributions.

39. The large proportion inhabiting the metropolis, will not escape observation. The number of the inhabitants of London and its suburbs, in 1861, was 2,803,034 out of a total population of England and Wales amounting to 20,205,504; that is, out of every 1000 persons inhabiting England and Wales, 143 were to be found in the metropolis, whereas in New South Wales, the numbers inhabiting Sydney were 267 to every 1000 of the population. If the distribution of the population in England and Wales were in the same ratio, the population in London in 1851 would have been nearly 5,894,869. The great preponderance of the metropolis in the location of the colonial population is due to various causes, but principally to the immense amount of exportable produce, the small number of persons employed to raise it, and the enormous business at the port of shipment. Whether this monopoly of population by the metropolis, and this denudation of the rural districts, are signs of healthy progress, is a question full of interest. Those who look more to immediate results than to the gradual and simultaneous development of the various elements which constitute national stature, regard with unmixed satisfaction the maturity of the colonial metropolis—the complete division of labour, the organization of industry, and the mental activity produced by the aggregation of so large a portion of the population into one centre.

Under any view, however, of the facts above stated they are calculated to show that the colony of New South Wales offers a home of comfort and plenty to the surplus population of the old world. Millions of acres are open to free selection even before survey, and with deferred payment at a uniform price of 20s. per acre. The climate is unequalled for salubrity, wages are high, food is cheap and abundant, taxation is light, the educational and religious wants of the community are provided for, the laws are impartially administered, and the country is governed under a constitution analogous to that which the inhabitants of the United Kingdom regard as their indefeasible birthright.

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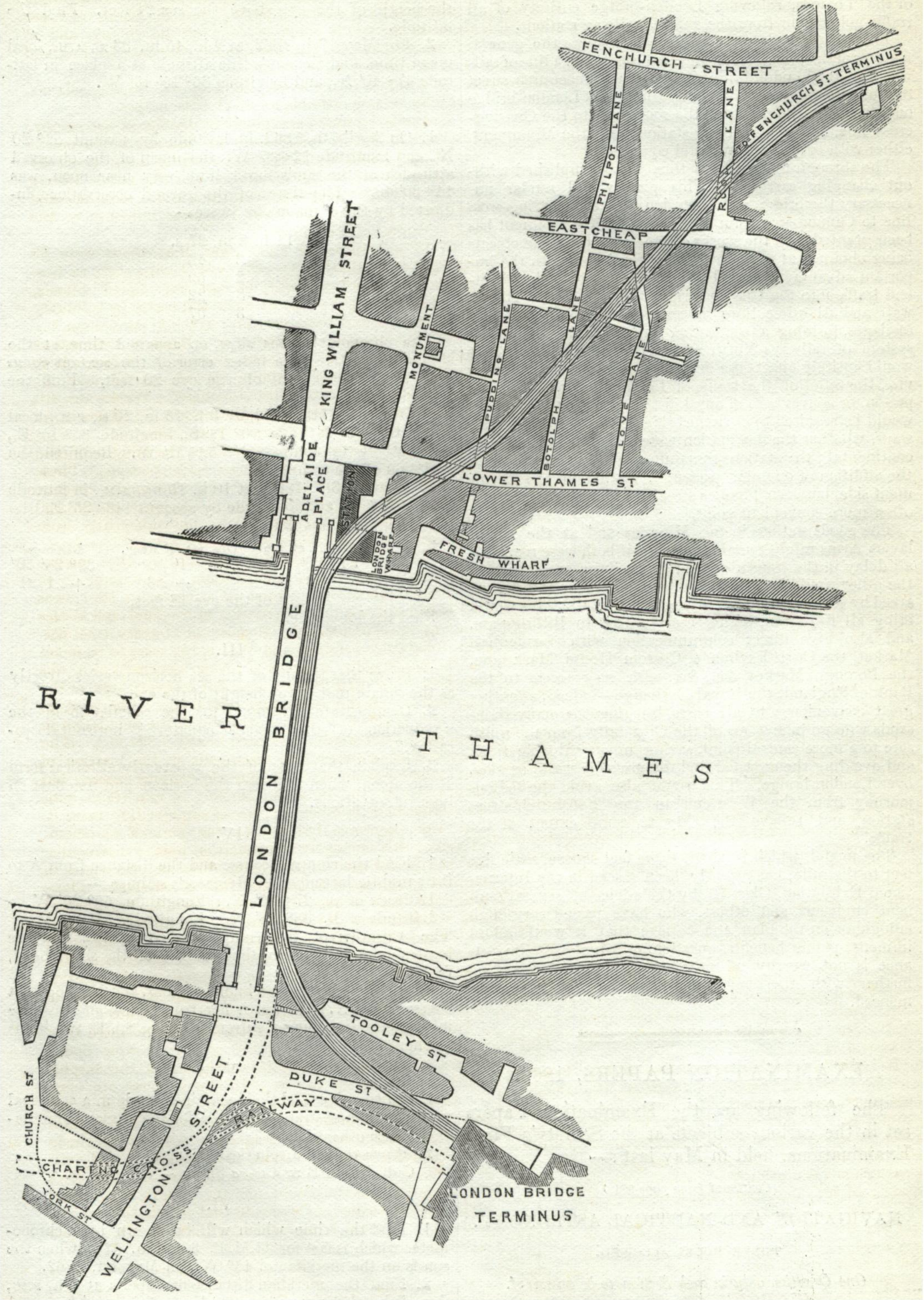
* These figures would lead to erroneous conclusions, unless it is borne in mind that they represent the total amount of capital, dividends, and reserved profits, not only of the banks which are confined to New South Wales, but of those in which that colony forms only one part of their field of operation.

* Government	£37,683
Private	13,734
Total, 1860	£51,417

LONDON TRAFFIC.



At the conversazione recently given by the Society of Mechanical Engineers, in the Egyptian Hall, at the Mansion House, a very interesting model was shown by Mr. Asprey, illustrating an ingenious plan devised by that gentleman for connecting all the railways north and south of the Thames, relieving London-bridge entirely of all traffic going to or from the various railway stations.

The wood-cut (see preceding page) shows the general features of the plan. Mr. Asprey proposes to run a line of railway from the London-bridge Station to the Fenchurch-street Station, crossing the Thames by the side of London-bridge on the east, with branch on the south side to the Charing-cross line, and a passenger station near the Monument, either with or without an hotel connected.

The through traffic might thus be accomplished without changing carriages. This plan would render unnecessary the bridge and extension from the Charing-cross line to Cannon-street, for which an Act of Parliament has been granted, and the works commenced, the same objects being obtained at an immense saving of cost, with the important advantages gained of not only carrying the West-end traffic into the City, but right through to the Blackwall and all other lines in connection without changing carriages, forming a connecting link between the whole system of railways North and South of London. This would entirely effect the one great necessity of the day, viz., the relief of the traffic of London-bridge. Not one person, or conveyance of any kind for goods or passengers, would be required to cross the bridge for either of the railways, whether the destination were far or near, home or continental; the stations remaining as they now are, with the addition of one new passenger station on the Monument side, between Thames-street and the River, or at any other more convenient point.

The goods stations in the Minories and at the Bricklayers Arms might remain the same, if both were required, all delay in the transmission of goods from one station to the other would be avoided, and much labour and money saved by sending all direct through by the rail. This would bring all fish (from either coast) direct to Billingsgate, and also give direct communication with Leadenhall Market, the Coal Exchange, Custom House, Mark-lane, the Borough Market, &c., &c., with easy access to the Bank of England, the Royal Exchange—indeed, affording great convenience to all parts, bringing the many thousands who go in and out of the City daily from the south side to a more central point, saving much valuable time, and avoiding the crowded and disagreeable walk, or ride, over London-bridge. This would also avoid the tedious journey from the West-end to the Fenchurch-street station, and relieve the City to some extent of the traffic.

The model, which is about three feet square, scale five feet to the mile, has recently been placed in the International Exhibition, Class 10, by the advice of several eminent engineers, and others, who have passed very high eulogiums on the plan, and believe that it would afford immense public benefits, questioning whether its importance is not worthy of consideration before proceeding further with the before-mentioned works just commenced.

EXAMINATION PAPERS, 1862.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

(Continued from page 571.)

NAVIGATION AND NAUTICAL ASTRONOMY.

THREE HOURS ALLOWED.

One Question only in each Section to be answered.

I.

1. On February 3rd, 1862, in longitude 22° 30′ E., the observed meridian altitude of the moon's lower limb was 60° 27′ 40″, the index error of the sextant *minus* 20″, and the height of the eye above the sea 24 feet. Find the latitude.

2. For May 17th, 1862, at 9 h. 45 m. 33 s., A.M., local mean time, find the sun's true altitude at a place in latitude 47° 40′ N., and longitude 36° 15′ 45″ W.

II.

1. On April 7th, 1862, in latitude by account 52° 20 N., and longitude 12° 25′ W., the mean of the observed altitudes of the sun's lower limb, very near noon, was 44° 30′ 40.″ The times of the several observations, indicated by the chronometer, were—

11 h. 2 m. 27 s.
2 43
2 59
3 22
3 57

The chronometer was slow, on apparent time, at the ship, 50 m. 18 s. The index error of the sextant *minus* 1′ 20″, and the height of the eye 20 feet. Find the latitude.

2. On April 19th, 1862, at 3 h. 15 m. 20 s., P.M., local mean time, in latitude 20° 19′ S., longitude 85° 15′ E., the sun bore by compass N. 52° 51′ W. Required, the variation of the compass.

3. January 3rd, 1862, at 10 h. 15 m., A.M., in latitude 51° 25′ 30″ S., and longitude by account 143° 25′ E., the following lunar was taken:—

	Obs. alt. of Sun.	Obs. alt. of Moon.	Distance.
	54° 29′ 50″	28° 1′ 50″	32° 28′ 50″
Index error	− 3 13	+ 33	+ 1 21

Height of the eye 18 feet.

Find the longitude.

III.

1. Prove that the dip of the sea horizon varies directly as the square root of the height of the eye.

2. Demonstrate a formula for the calculation of the "reduction of the moon's equatorial horizontal parallax."

3. Explain the cause of the apparently elliptical form of the moon, when it is near the horizon, and its effect on lunar observations.

IV.

1. Find the compass course and the distance from A to B by middle latitude and Mercator's sailings:—

Latitude of A, 27° 16′ N.; Longitude, 55° 20′ W.
Latitude of B, 38° 18′ N.; Longitude, 51° 30′ W.

The variation of the compass 14° 30′, W., and the local deviation due to the position of the ship's head, 7° 30′ E.

2 A ship steams seven knots an hour, and her apparent course is W.N.W., what is her true course and distance in 5½ hours, supposing a current drifting S.b.E. two knots per hour?

V.

Given two sides and their contained angle in a spherical triangle; demonstrate a formula for the direct computation of the other side.

2. Prove that in a spherical triangle—

$$\text{Cot. } A \text{ Sin. } B = \text{Cot. } a \text{ Sin. } c - \text{Cos. } B \text{ Cos. } c.$$

VI.

1. Find the time which will be shewn by a chronometer which is fast for G.M.T. 3 h. 4 m. 52 s., when the sun is on the meridian of 45° W., on May 1st, 1862.

2. Find the meridian distance of Capella at 8 h. P.M., June 7th, 1862, for a place 90° East of Greenwich.

VII.

1. Investigate the method given in the "Nautical

Almanac" for finding the latitude by means of altitudes of the Pole-star.

2. Investigate the formula for computing the "reduction to the meridian" of altitudes taken near the time of a star's transit.

VIII.

1.—Give the principles of the construction of Mercator's chart.

2. Describe the method of navigating by great circle sailing.

3. Describe the adjustments of the sextant.

PRINCIPLES OF MECHANICS.

THREE HOURS ALLOWED.

1. Define force. How is it measured statically, and how dynamically?

2. Find the resultant of two parallel forces acting in the same plane on a rigid body. Two parallel forces, which are as 3 to 5, act on a line, in opposite directions, at a distance of 12 inches; required the magnitude and position of the third force which will balance them.

3. State and prove the conditions of equilibrium of forces applied in any manner to a lever. What are the respective weights borne by two men who carry a burden of 200 lbs. slung from a pole 4 feet long, the weight being 6 inches from the middle?

4. Investigate the ratio of power to weight on the inclined plane, and hence show under what circumstances the mechanical advantage is greatest. A power of 50 acts at an angle of 45° with the incline of a plane, whose height is to its length as 1 to 2; required the weight which it will support.

5. What are the conditions requisite for the equilibrium of a vertical frame-work of jointed beams?

6. Show how to express the motion of a body on an inclined plane.

7. A body is projected up an inclined plane, whose height is $\frac{1}{8}$th of its length, with a velocity of 50 feet per second; find its place and velocity after the lapse of 6 seconds.

8. If a body describe an ellipse under the action of a central force tending towards a focus of the ellipse, then the force varies inversely as the square of the distance.

9. Show how to find the limits within which the velocity of a fly-wheel varies, when the force of the piston is constant.

10. State the difference between the effects of a pressure applied to a solid and a fluid respectively. What hydrostatical facts result from this difference?

11. Explain the meaning of the terms "whole pressure," "resultant pressure," on a surface immersed in a fluid. Find the amounts of these two pressures on a globe, 1 foot in diameter, just immersed in a trough of mercury, whose specific gravity is 13.58.

12. Describe a fire-engine, and explain its mode of working.

13. Show how the barometer is used to ascertain the heights of objects. What corrections are used in the calculations, and on what grounds are they introduced? Illustrate your remarks by a case of your own supposition.

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

1. Describe Newcomen's atmospheric steam-engine, and explain the method of working it. What radical defects are inherent in an engine of this description?

2. State briefly the principal improvements which have been introduced by Watt into the construction of the steam-engine.

3. Sketch the slide-valve commonly used in locomotive engines, and explain its action. What is the meaning of the terms, "lap," and "lead," as applied to a slide-valve?

4. Describe some form of equilibrium valve.

5. Explain any arrangement of mechanism suitable for actuating the slide-valve of a steam-engine.

6. Describe in general terms the construction of a "lathe." What is the principle of the slide-rest? How is the slow motion given to the mandril of a lathe?

7. Explain the use of change-wheels in a screw-cutting lathe.

8. In a machine for planing iron, mention some of the methods employed for imparting a reciprocating motion to the table, and point out which of these methods allow of the motion in one direction being made more rapid than that in the other.

9. In the operation of drilling, the spindle which carries the cutter revolves, and at the same time advances slowly in the direction of its length: how can this movement be obtained in a self-acting drilling-machine?

10. Describe the anchor-escapement, and point out its use in a clock.

11. Explain the contrivance known as "Hooke's universal joint."

12. It is often desirable to record, mechanically, the number of impressions taken in a printing-machine: in what manner may counting-wheels be constructed and arranged so as to effect this object?

ELECTRICITY, MAGNETISM, AND HEAT.

THREE HOURS ALLOWED.

1. Explain the poles of a magnet, and state their properties.

2. Can magnetism be justly called an attractive force? Prove your answer by experiment.

3. Explain the best mode of constructing a mariner's compass, and the kind of error of deviation that may be thereby avoided.

4. State the three elements of the earth's magnetic force, and the means by which their changes have been observed and recorded.

5. Describe the peculiar magnetic properties possessed by the metal *bismuth.*

6. Explain the kinds of electricity, and the means by which they may be respectively recognised.

7. Distinguish between an electrometer and an electroscope. Describe the construction of Coulomb's torsion electrometer.

8. When the free electricity of any body is disturbed by the proximity of an electrified body, what is the action called? Give some experimental illustration.

9. Explain the theory of the different effects produced, when a point, or a knob, is presented to an electrified body.

10. State the conditions on which the efficiency of a lightning conductor depends.

11. Describe the origin and nature of a voltaic current, and the actions which take place in the battery-cell.

12. Explain the construction and relative advantages and disadvantages of the batteries of Daniell, Smee, and Grove.

13. What is the construction of the apparatus for obtaining electricity of high tension, by the agency of a voltaic current?

14. Explain the construction and use of Wheatstone's magneto-electric telegraph.

15. What is the nature and construction of the apparatus by means of which the most delicate experiments on heat may be made?

16. State your opinion of the nature of heat, and your reasons for it.

17. Describe and illustrate the various modes of transmission of heat.

18. Explain and illustrate by experiment the relations between the radiation and absorption of heat in gaseous bodies, and show the importance of the principle in the conservation of terrestrial heat.

19. Explain, and illustrate by some experiment, the specific heat of bodies.

20. Explain the phenomena of evaporation, the formation of dew, and the construction of the *cryophorus.*

(To be continued.)

Home Correspondence.

SUBMARINE EXPLOSIVE SHELLS.

Sir,—Never, in the changes of engines of war, has there been a period so perplexing as the present, in the adoption of destructive inventions to which we have been helped by modern appliances.

So great a change has been brought about since 1815, that those to whom our national defences are entrusted know not what course to pursue that shall best conduce to the safety of England and to the supremacy of her navy.

In this state of indecision, I venture to express a confident belief, due to a long study of the subject, that submarine explosive shells will, in some form, supersede to a great extent the employment of cannon in naval warfare. And in order to save a further waste of skill and labour upon monster war vessels and cannon, I do most earnestly advise that one of our worthless line-of-battle ships be turned adrift, under sail, in the North sea, and there experimented upon by a fast steamer armed with submarine explosive shells, variously charged, in order to ascertain what charge of gunpowder or other explosive agent is necessary to bilge a ship to such an extent that she may either slowly or immediately sink.

We have hitherto directed our attention solely to the top-sides of ships; but the day is not far distant when ships' bottoms, not their top-sides, will have to endure the destructive capabilities of an arm vastly superior in naval combat to any gun which can be used on shipboard.

I am fully aware that this is a subject extremely distasteful to us gentlemen in the profession of arms. "What is to become of us if such infernal contrivances come into use?" I would reply, what is to become of England and her supremacy on the seas, if she be forestalled by a foe who may have no regard for chivalrous and antiquated notions of warfare? Is the prediction of one of our best authorities, now no more, upon engines of war to be verified? "England will be compelled to adopt the submarine explosive shell when she shall, to her cost, have had experience of its destructive capabilities." But, nevertheless, it is *the* arm, of all yet known, the best adapted to the defence of insular England.

I am, &c.,
JOHN HARVEY, Capt. R.N.

Cheltenham, July 28th.

CONDENSED AIR FURNACES.

Sir,—In the letter on this subject which you did me the honour to insert in your last number, considerations of space prevented me from adverting to the experiments already tried, and the facts thereby ascertained respecting the effects of combustion in condensed air. I will now, with your permission, supply the omission.

Sir Humphry Davy, in his papers upon "Flame," first published in the Philosophical Transactions for 1817, mentions the results of some experiments he had tried by burning different combustibles, both in rarified and condensed air. The latter, he observed, "presented considerable difficulties," but were sufficient to show "that as rarifaction (for certain limits at least) does not diminish considerably the heat of flame in atmospheric air, so neither does condensation considerably increase it." This is but the expression of a law now well established—namely, that if the combustion is perfectly accomplished, the absolute *quantity* of heat evolved is the same under all circumstances. With regard to light the case was different. "The intensity of the light of flames in the atmosphere is increased by condensation and diminished by rarifaction, apparently in a much higher ratio than their heat, more particles capable of emitting light existing in the dense atmosphere." Sir H. Davy did not pursue this part of the subject far, his practical object at the time being to prosecute the researches which finally led to the invention of the safety lamp.

Between 1817 and 1859 no further experiments of any scientific value were instituted on this point. M. Triger, a French engineer, charged with the execution of some subaqueous works on the Loire, reported, indeed, in 1841,* that ordinary candles, burning under a pressure of three atmospheres, consumed very fast, and emitted "*une fumée épouvantable*," so that he was obliged to have the wicks made of silk instead of cotton. But his observations went no further, and probably from want of time he did not follow up the inquiry which the phenomenon suggested.

It is to Dr. Frankland that we owe nearly the whole of our present information on this subject. That gentleman was the first to surround his experiments with the precautions, and conduct them in the manner that could alone endue the results with any really scientific certainty. His first trials were accomplished during an ascent of Mont Blanc. Dr. Frankland commenced by burning a series of stearine candles at Chamounix, noting the number of grains of material consumed in a given time, and afterwards repeating the experiment on the summit. He found that the consumption of the candles was nearly equal in both cases, the slight difference being probably attributable to the decreased temperature at the higher level, but at the same time he "was much struck with the comparatively small amount of light which they emitted. The lower and blue portion of the flame, which under ordinary circumstances scarcely rises to within a quarter of an inch of the wick, now (*i.e.*, on the summit of the mountain), extended to the height of an eighth of an inch above the cotton, thus greatly reducing the size of the non-luminous portion of the flame."†

Further experiments were afterwards tried in glass globes attached to exhausting pumps, and gave similar results, which Dr. Frankland, by very ingenious methods, succeeded in analysing and measuring. The progressive phenomena are highly curious. "During the diminution of pressure down to half an atmosphere (15 inches of the barometer), the chief alteration is the gradual invasion of the upper portion of the flame by the lower and non-luminous part. As the pressure sinks towards 10 inches of mercury, the retreat of the luminous portion of the flame proceeds uninterruptedly, but the shape and colour of the flame also begin to undergo a very remarkable alteration. The summit becomes more and more rounded, until at 10 inches pressure the flame assumes nearly the form of an ellipse, whilst the blue portion, which now comprised nearly the whole flame, acquires a peculiar greenish tint. Finally, at 6 inches pressure, the last trace of yellow disappears from the summit of the flame, leaving the latter an almost perfect globe of a peculiar greenish-blue tint."

This peculiar tint Dr. Frankland thinks ought to be assigned to the presence of incandescent nitrogen. He proceeds to set forth a number of tables exhibiting the gradual diminution of light from the flame burnt under diminished atmospheric densities, the mean result of the whole series being that about 5 per cent. of light is lost or gained by every fall or rise of one inch in the mercurial barometer. As Dr. Frankland states the case :—" Of 100 units of light emitted by a gas flame in air at a pressure of 30 inches of mercury, 5.1 units are extinguished for each diminution of one mercurial inch of atmospheric pressure." In extending his experiments in the other direction, that is to say, into denser air than the average atmosphere, Dr. Frankland, like Sir H. Davy, encountered "considerable difficulties," which it required much trouble and ingenuity even partially to overcome. The result is given in the subjoined table :—

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* Annales de Chimie for 1841.

† Philosophical Transactions for 1861.

Proportion of light at 30 in.	100
,, ,, at 60 in. (2 atmospheres)	262
,, ,, at 90 in. (3 ditto)	406
,, ,, at 120 in. (4 ditto)	959

Assuming, as from analogy we are entitled to do, that the intensity of light affords a measure for the intensity of heat, under corresponding circumstances, we may conclude from Dr. Frankland's experiments, that in an atmosphere of double pressure, the attainable maximum of heat is two-and-a-half times greater than the ordinary range ; the increase in a pressure of three atmospheres being in the proportion of four to one, and in four atmospheres nine and a half to one. As these results entirely coincide with the deductions drawn from *à priori* and theoretical considerations, they may be accepted without misgiving.

As an illustrative fact, pointing in the same direction, I may refer to the circumstance, well known to iron masters, that the product of their furnaces is noticeably larger in winter, when the air is dense and cold, than during the hot months of summer. This difference sometimes extends to as much as 10 per cent. in the daily yield of pig iron from the same furnace, and by an equal consumption of fuel, although the condensation produced by cold is equivalent to only $\frac{1}{480}$ for every 1° of Fahrenheit.

Both Dr. Frankland and Sir H. Davy tried their experiments in glass globes, which were necessarily small in dimensions, in order to secure strength enough to resist the internal pressure. The difficulties of all sorts which were then encountered will altogether disappear in the condensed air-chambers which I propose to construct. Here the furnace itself, the gas flame, and other burning fuel, together with the apparatus required for experiments and the attendants thereupon, are included in an air-tight room, filled and supplied with air at any density that may be wanted. The manipulator, under these circumstances, can conduct his experiments under a pressure of three or four atmospheres, nearly, if not quite as freely as in the open air, and will be able to investigate a new and fertile field of scientific research. Besides the novel conditions of combustion and development of light and heat under these hitherto untried conditions, many new features will present themselves in other departments of inquiry. All fluids boil and evaporate at a higher temperature under increased pressures, and many curious phenomena will be elicited when the experimentalist is able to " try conclusions " with water at a boiling point of 260°, or even 300° Fahr., instead of 212°. Irrespective of all commercial uses, in the intensity of heat or economy of fuel, the employment of " condensed air" as I propose, promises to yield, not only a new field, but also a new instrument for philosophical research. I believe that I am not too sanguine in anticipating its adoption as a useful adjunct in the laboratory, as well as a serviceable agent for commercial purposes.

I am, &c.,
A. J. JOYCE.

15, Cambridge-terrace, Hyde-park, July 28, 1862.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par
Numb.

Delivered on 11th July, 1862

572. East India (High Court of Calcutta)— Copy of the Charter, &c.
73. Parliamentary Proceedings—Report from Committee.
81. Corn and Grain, &c.—Accounts.

Delivered on 12th and 14th July, 1862.

384. Civil List Pensions—Paper.
385. Army (China)—Returns.
387. Channel Islands' Garrisons—Return.
389. Poor Relief (Lancashire, &c.)—Return.
390. Sugar Duties—Report from Committee.
391. Ocean Steam Mail Contracts—Return.
392. Navy (Shot-proof Ships)—Return.
394. Committee of Selection—Seventh Report.
271. Ecclesiastical Registries—Return.
382. Public Offices Extension Bill—Copy of Plan.
386. Army, Ordnance, and Navy—Returns.
395. Militia Estimates—Report from Committee.
393. Bankruptcy Act (1861)—Report from Committee.
201. Bills—Charity Commissioners' Jurisdiction.
202. ,, Queen's Prison Discontinuance (1862).
203. ,, Weights and Measures (Ireland) Act (1860) Amendment (amended.)

Affairs in Mexico—Correspondence (Part 3.)

Delivered on 15th July, 1862.

100. Salaries, Pensions, &c.—Return.
374. Income Tax, &c. (Metropolis)—Return.
379. Poor's Rate Summonses—Return.
388. Income Tax (Kettering District)—Returns.
400. Expiring Laws—Report from Committee.
203. Bills—Judgments Law Amendment (Ireland) (amended by the Select Committee.)
204. ,, Night Poaching Prevention.

Public General Acts—Cap. 24, 25, 26, 27, 28, 29, and 30.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July 25th*, 1862.]

Dated 3rd May, 1862.

1307. H. Juhel, Bordeaux, France—An imp. in wheels. (A com.)
1316. G. Neall, Islington—Improved apparatus for obtaining and applying motive power, especially applicable to propelling carriages on common roads.

Dated 8th May, 1862.

1377. A. Bearne, 24, Union-street, Torquay—Imp. in the construction of boots, shoes, and goloshes, rendering them elastic to pressure.

Dated 19th May, 1862.

1517. A. V. Newton, 66, Chancery-lane—Improved machinery for splitting leather. (A com.)

Dated 14th June, 1862.

1767. J. Lancelott, Clifton-terrace, Birmingham—Imp. in the manufacture of ornamental chains from sheet metal.

Dated 21st June, 1862.

1836. A. F. Maigron, Marseilles, France—Imp. in machinery or apparatus for the manufacture of tow or oakum, and for winding off, carding, and spinning all kinds of fibrous fabrics.

Dated 24th June, 1862.

1855. J. Johnston, Paisley—Imp. in hats.

Dated 25th June, 1862.

1863. J. Whitham, Leeds—Imp. in the apparatus used in working oil and other hydraulic presses.

Dated 26th June, 1862.

1873. E. T. Hughes, 123, Chancery-lane—Imp. in regulating or moderating the movement of the keys of pianofortes. (A com.

Dated 28th June, 1862.

1897. G. H. Hulskamp, 53, Chancery-lane—Imp. in pianofortes.

Dated 30th June, 1862.

1910. W. F. Murray, Glasgow—Imp. in the manufacture of stoneware bottles, and in apparatus connected therewith.
1912. W. Easton, Oakinellgate, Gateshead-on-Tyne, and G. Donkin, Bill Quay, Gateshead-on-Tyne—Imp. in lears or annealing chambers, and apparatus used in annealing glass.

Dated 3rd July, 1862.

1937. T. Turner, Fisher-street, and W. Taylor, Ashton New Town, Birmingham—Certain inp. in single and double breech-loading fire-arms.
1939. W. A. Gilbee, 4, South-street, Finsbury—An improved manufacture of blue colouring matter. (A com.)

Dated 7th July, 1862.

1956. C. Wessely, 22, Canterbury-place, Lambeth-road—Imp. in carriages.

Dated 8th July, 1862.

1961. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in wet gas meters. (A com.)
1963. J. Brown, Middleton, Lancashire—An improved motion for actuating the doffers of carding engines for carding cotton and other fibrous substances.
1865. C. Slatford, Cannon-street West—Imp. in trimmings, tufts, and other articles for ornamental and decorative purposes.

1966. J. Rigby, Suffolk-street, Dublin—Imp. in breech-loading fire arms, and in extracting cartridges from such guns, and also in wind sights for fire-arms.
1969. H. Wethered, Bristol—Imp. in the construction of handles, latches, or fastenings for doors, gates, and windows.

Dated 9*th July*, 1862.

1970. W. L. Wiggington, 4, Clifton-cottages, Hammersmith—An improved method of, and apparatus for, curing smoky chimnies.
1973. A. Gilbey, Oxford-street—Imp. in apparatus for washing and cleansing bottles.
1975. J. Rhodes, Morley, near Leeds—Imp. in rag machines. (A com.)
1977. H. Eschwege, 14, Mincing-lane—Imp. in purifying wood and other vinegar.
1978. G. T. Bousfield, Loughborough-park, Brixton—Imp. in washing machines. (A com.)
1979. E. S. Hindley, Bourton, Dorsetshire—Imp. in apparatus used when circulating hot water for warming dwelling houses and other places, which apparatus may be used for cooling and condensing.
1981. S. V. Evers, 80, Lower Thames-street—Imp. in the preparation of beverages. (Partly a com.)

Dated 10*th July*, 1862.

1983. W. F. Reynolds, Commercial-road — An improved watch pendant.
1985. H. Kellogg, New Haven, U.S.—Imp. in breech-loading fire-arms and cartridges therefor.
1986. J. Mander, Birmingham—Imp. in crochet needles and crochet needle holders.
1987. A. Bonnell, Hethpool-street, Maida-hill—Imp. in churns. (A com.)
1989. E. J. Biddle, Grosvenor Hotel, Pimlico—The use of petroleum or coal oil as fuel, and also for the machinery and apparatus to be employed for this purpose.
1991. J. Leeming, North Holme Mills, Bradford—Imp. in jacquard or index machines.
1992. D. Steele, Bunhill-row, Finsbury—Imp. in the method of flushing or distributing the water in pans or basins applicable to waterclosets, urinals, wash-hand basins, or other purposes.
1993. T. Farra, Manchester—Imp. in wearing apparel, called skirts or petticoats and frocks.
1994. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in braiding machines. (A com.)

Dated 11*th July*, 1862.

1995. J. R. Hill, 7, Duke-street, Adelphi—An improved governor for the engines of steam vessels.
1996. M. Cornall and E. Griffiths, Manchester—Imp. in doubling, twisting, and reeling threads and yarns of cotton and other fibrous materials.
1997. J. Waithman, Manchester—Imp. in machinery or apparatus for carding flax, tow, or other fibrous materials.
1999. J. Orr, Glasgow—Imp. in weaving piled fabrics, and in the machinery or apparatus connected therewith.
2000. J. Miller, Lambeth—Imp. in apparatus for steering ships and other vessels.
2001. W. Bliss, Chipping Norton, Oxon—Imp. in heating ores, and in generating steam, and also in the apparatus employed therein. (A com.)

Dated 12*th July*, 1862.

2002. C. E. Green, 13, Blandford-street, Portman-square, and J. Green, Windermere-cottage, Winchmore-hill, Edmonton—Imp. in breech-loading fire arms.
2003. J. P. Lees and J. Beard, Ashton-under-Lyne—Certain imp. in carding engines.
2005. J. Hunt. Queen's Mill, Preston—Imp. in the process of sizing and drying yarns or threads, and in the apparatus employed in such process.
2007. T. Hill, Hampton-house, Great Warley, Essex—Imp. in the arrangements employed for the protection of markers at rifle butts, and in the means employed in indicating the score and position of the shot and wiping out the shot mark.
2008. E. T. Hughes, 123, Chancery lane—An improved system of winding or rolling silk thread on moulds or bobbins, and placing them in suitable boxes. (A com.)
2009. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for washing ores and minerals. (A com.)
2010. W. E. Gedge, 11, Wellington-street, Strand—Imp. in the manufacture of hats. (A com.)
2011. Dr. P. Plassan, Tours, France—An improved orthopædic apparatus for straightening the human frame.
2013. H. Barber, 60, Thomas-street, and H. De Garrs, 34, Pomond-street, Sheffield—Imp. in rolling iron, steel, and other metals for cutlery tools and other purposes.
2014. Hon. W. E. Cochrane, Osnaburgh-terrace, Regent's-park—Imp. in railway fastenings.

Dated 14*th July*, 1862.

2015. E. Taylor, 167, Regent-street—Imp. in the manufacture of buttons.
2016. G. Lowry, Salford—Imp. in machinery for carding and cleaning cotton and other fibrous materials.
2017. W. E. Gedge, 11, Wellington-street, Strand—An improved portable or stationary steam lift and force pump. (A com.)
2019. C. Crossley and J. W. Crossley, Halifax—Imp. in means or apparatus employed in washing and finishing textile fabrics.
2020. S. Partridge, Darlaston, Staffordshire—Imp. in railway signals.
2021. P. Sanderson and R. Sanderson, Galashields, Selkirk, N.B.—Imp. in the manufacture of woven fabrics, and in the machinery or apparatus employed therein.
2022. W. G. May, Glasgow—Imp. in apparatus for extending tables.
2023. P. A. L. Canonicat, Rue des Petits Peres, No. 50, Marseille—Imp. in filtering water, and in apparatus employed therein.
2024. G. Fawcus, North Shields—Imp. in building boats.
2025. F. M. Parkes, Plumstead, Kent—Imp. in the manufacture of gas for lighting and heating, and in apparatus employed in the said manufacture.
2027. R. Ridley, Morlui, near Leeds, and J. G. Jones, 4, Cambridge-villas, Battersea, Surrey—Imp. in machinery and apparatus for ventilating mines and other places.

Dated 15*th July*, 1862.

2028. A. Leslie, Turriff, Aberdeen, N.B.—Imp. in apparatus for applying steam or other motive power to cultivate the soil, and to actuate wheeled carriages.
2030. J. Green, Newtown, Worcester—Imp. in the method and means of producing signals, and in the applications of the same, particularly to steam ploughs or cultivators.
2033. W. Dickens, Salford, and J. Hewitt, Manchester—Imp. in self-acting and hand mules employed in spinning cotton and other fibrous materials.
2034. C. E. Crawley, 17, Gracechurch-street, and F. Foster, 7 Ashley-crescent, City-road—Imp. in safety or miners' lamps.

Dated 16*th July*, 1862.

2036. B. Johnson, Chester, and E. H. Taylor, Coed Talon, near Mold, Flintshire—Imp. in rope wheels, cages, and tanks used for mines, collieries, and other similar purposes.
2037. G. T. Selby, Smethwick, Staffordshire—Imp. in apparatus for superheating in tubes and tubular articles, and machinery for the manufacture thereof.
2038. L. R. Bodmer, 2, Thavies-inn, Holborn—Imp. in apparatus for winding up watches and other time keepers. (A com.)
2039. W. Henson, Nottingham, and W. W. Clay, Sneinton, Nottingham—Imp. in knitting machinery, and in apparatus connected therewith.
2040. A. V. Newton, 66, Chancery-lane—An imp. in sewing machines. (A com.)
2041. C. Sanderson, Sheffield—Imp. in the manufacture of crinoline or crinoline steel.

Dated 17*th July*, 1862.

2046. J. G. Harkness, Birkenhead—An improved safety handle for winches, cranes, and other like machines.
2048. T. B. Daft, 2, Queen-square, Westminster—Imp. in the manufacture of mats, and other surfaces where vulcanised india-rubber is employed.

Inventions with Complete Specifications Filed.

2052. O. F. Morrill, Massachusetts, U.S.—A certain new and usefu apparatus for generating heat for culinary or various other purposes—18th July, 1862.

Patents Sealed.

[*From Gazette, July* 25*th*, 1862.]

July 25*th*.
209. W. Orr.
229. J. H. Brierley.
236. J. B. Harby.
243. G. Phillips, sen., and G. Phillips, jun.
278. T. Cook.
282. L. Hill.
290. G. Manwaring.
297. J. Webster.
300. W. E. Taylor.
308. J. B. Payne.
400. J. H. Johnson.
425. J. Combe.
470. W. Ashton.
498. W. E. Newton.
856. W. E. Gedge.
1185. J. H. Johnson.
1238. A. V. Newton.
1350. J. H. Johnson.
1352. J H. Johnson.
1592. W. Palmer.

[*From Gazette, July* 29*th*, 1862.]

July 29*th*.
249. W. Davies.
257. H. Schatten.
262. P. Scheurweghs and A. J. A. H. de Boisserolle.
264. E. H. C. Monckton.
269. W. Smith.
280. F. Riesbeck & W. Becker.
284. C. W. Lancaster.
288. W. Clark.
293. J. L. Norton.
299. D. Gallafent.
211. A. C. Bamlett.
320. J. Tonkin, jun.
328. W. Clark.
330. W. H. Bartholomew.
339. M. A. F. Mennons.
356. W. Wood.
378. M. A. F. Mennons.
484. M. A. F. Mennons.
606. T. Hack and A. E. Carter.
994. J. Whitehouse.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, July* 25*th*, 1862.]

July 25*rd*.
1761. P. A. Viette.
July 26*th*.
1744. J. Scoffern.
1747. E. Hunt and H. D. Pochin.
1765. J. Wood.
97. C. A. Girard.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, July* 29*th*, 1862.]

July 22*nd*.
1691. W. Weallens & G. A. Crow.
July 23*rd*.
1693. C. Schiele.
1860. V. Delperdange.
1850. A. V. Newton.
July 26*th*.
1732. J. Hanson.